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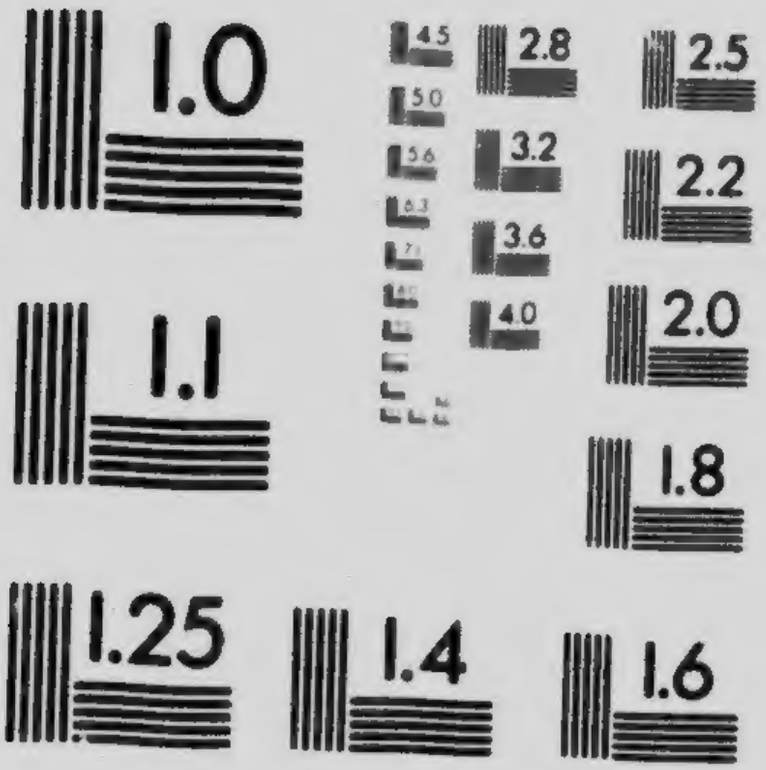

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REPORT

OF THE

CANADIAN ARCTIC EXPEDITION
1913-18

VOLUME III: INSECTS

PART A: COLLEMBOLA

By JUSTUS W. FOLSOM

SOUTHERN PARTY—1913-16

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OTTAWA
J. de LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1919

Issued July 10th, 1919

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Collembola of the Canadian Arctic Expedition, 1913-18.

By Justus W. Folsom

Of the University of Illinois.

This is a report on the Collembola obtained by the Canadian Arctic Expedition, 1913–16. The material, collected by Mr. F. Johansen, consisted of numerous well-preserved specimens, in excellent condition for study, and comprised the following twelve species:—

Podura aquatica L.
Achorutes tullbergi Schäf.
Achorutes sensilis, n. sp.
Achorutes armatus (Nic.)
Onychiurus duodecimpunctatus, n. sp.
Tetracanthella wahlgreni Axels.
Folsomia quadrioculata (Tull.).
Isotoma viridis Bourl.
Isotoma palustris (Müll.).
Entomobrya comparata, n. sp.
Lepidocyrtus cyaneus Tull
Sminthurides aquaticus (Bourl.).

The types and other specimens upon which this report is based are deposited in the National Collection of Insects, Ottawa.

Podura aquatica Linnaeus.

Plate 1, figs. 1–3.

Podura aquatica Linnaeus, 1758.—Nicolet, 1841.—Tullberg, 1871, 1872.—Lubbock, 1868, 1873.—Packard 1873.—Parona, 1879, 1882.—Dalla Torre, 1886, 1895.—Uzel, 1890.—MacGillivray, 1891.—Schött, 1894, 1902.—Reuter, 1895.—Schäffer, 1896, 1900a, 1900b, —Lie-Pettersen, 1896—Poppe and Schäffer, 1897.—Scherbakov, 1898b.—Carl, 1899, 1901.—Wahlgren, 1899c, 1906a.—Carpenter and Evans, 1899.—Absolon, 1900, 1901.—Willem, 1900.—Börner 1901a.—Krausbauer, 1901.—Agren, 1903.—Guthrie, 1903.—Axelson, 1906.—(Axelson) Linnaniemi, 1907, 1912.—Folsom, 1916.

Hypogastrura aquatica [illegible]let, 1839.
Hydropodura aquatica [illegible]er, 1901b, 1902.
Podura granulata MacGillivray, 1893.

Blackish blue; antennae and legs reddish brown; furcula pale brown. Head hypognathous. Eyes 8 + 8. Ocular areas with conical elevations between the eyes. Postantennal organs apparently absent, represented externally by minute rudiments. Antennæ shorter than the head, stout, cylindrical, with segments about as 4:5:6:7 in relative lengths. Olfactory hairs of fourth antennal segment absent. Sense organ of third antennal segment consisting of a pair of short stiff setæ. Body short and stout. A dorsal subsegment occurs on the anterior part of each body segment except the ninth. Unguis (fig. 1) very long, longer than the tibio-tarsus, slender, curving, unidentate behind the

middle of the inner margin. Unguiculus represented only by a toothlike rudiment. Tenent hair single, unknobbed. Rami of tenaculum quadridentate. Furcula very long, extending as far as the first pair of legs, clearly appended to the fourth abdominal segment. Manubrium short. Dentes long, strongly bowed outward, apically convergent, with an obsolete transverse suture two-fifths from the base, and with the tubercles of the distal third arranged in transverse rings. Mucrones (figs. 2, 3) three-fifths as long as hind ungues, with outer and inner lamellæ, and with a prominent dorsal rounded-triangular basal lobe. Anal spines absent. Body clothing of few minute curving setæ; dens with 12 to 17 long curving dorsal setæ, most of which are in two longitudinal series. Integument tuberculate. Length, 1·3 mm.

Podura aquatica, one of the most abundant collembolans in Europe and North America, occurs on the surface of standing water on the margins of ponds and streams, having special structural adaptations for a semi-aquatic life. It swarms on vegetation or rubbish along the shore, and at times is blown against the shore in masses of enormous numbers. This species often appears in fresh-water aquaria, and is essentially a fresh-water species, though it has been found occasionally in pools of brackish water on the seashore.

The species has been recorded from Siberia. From Canada, I have specimens taken at Arnprior, Ont., May 19, 1917, by Mr. Charles Macnamara.

Great numbers on ponds, Demarcation point, Alaska, May 16, 1914; abundant, large and small, at Bernard harbour, Dolphin and Union strait, Northwest Territories, June 25, 1915. F. Johansen.

Achorutes tullbergi Schäffer.

Plate 1, figs. 4-10; plate 2, fig. 11.

Achorutes dubius Tullberg, 1876. Uzel, 1890.—Schott, 1894.—Dalla Torre, 1895.—Schäffer, 1896.—Skorikow, 1900.

Achorutes dubius, var. *concolor* Carpenter, 1900.

Achorutes tullbergi Schäffer, 1900a.

Achorutes tullbergi, var. *concolor* Schäffer, 1900a.—Wahlgren, 1907.—Folsom, 1916.

Pigmented with irregular patches of dark blue pigment (typical form) or uniformly pigmented (var. *concolor*). Eyes (fig. 4) eight on each side. Postantennal organs (fig. 4) with four (sometimes five) peripheral tubercles. Antennæ shorter than the head, with segments 1:8:6:7:9:9 in relative lengths. Sense organ of third antennal segment as in fig. 5. Ungues (fig. 6) stout, slightly curving; inner margin unidentate one third from apex. Unguiculi with setaceously prolonged outer margin and with the basal lamella subobblong on the second and third pairs of feet. Tenent hairs knobbed; 2,3,3, as a rule; occasionally 3,3,3, or 1,3,3. Mucrones (figs. 7-9) one-third dentes in length, apically rounded, with narrow outer lamella. Rami of tenaculum quadridentate. Anal spines (figs. 10, 11) two, half as long as hind ungues, arcuate, on prominent contiguous papillæ. Clothing of sparse short curving setæ, with longer setæ on the posterior part of the abdomen. Length, 2 m.m.

The specimens collected by the Expedition belong to the variety *concolor* Carp., which has been taken hitherto in Franz Josef Land, Ellesmere land, Bohemia and Massachusetts. The typical form of the species has been reported from Nova Zembla, Spitzbergen and Siberia.

Several specimens on ponds and from rotten driftwood, Bernard harbour, Northwest Territories, May, 25, 1916, June 18, 19, 1915; also several under driftwood, Demarcation point, Alaska, May 16, 1914. F. Johansen.

Achorutes sensilis, n. sp.

Plate 2, figs. 12–18

Uniform dark blue. Eyes 8 + 8. Postantennal organs (fig. 12) small, slightly longer than the diameter of an eye, with four peripheral tubercles. Antennæ shorter than the head, with segments in relative lengths about as 5:6:7:7. Third antennal segment with many distal lateral sensory setæ (fig. 13). Unguis (fig. 14) long, slender, feebly curving, unidentate two-fifths from the apex. Unguiculus extending one-half as far as the unguis, with proximal half subovate and distal half acuminate. One long knobbed tenent hair. All the distal tibio-tarsal setæ are apically bent and minutely knobbed. Rami of tenaculum tridentate. Dentes three times as long as mucrones, each with a long curving subapical dorsal seta. Mucro about as long as hind unguiculus, variable in form (figs. 15, 16), with broad outer lamella and narrow inner lamella. Anal spines (fig. 17) short, stout, feebly curving, one-fifth as long as hind unguis, on contiguous papillæ one-third as long as the spines. Clothing (fig. 18) of few short stout curving setæ and longer stout suberect setæ, the latter often feebly dentate. Maximum length, 2·2 mm.

I regarded this form as being *A. viaticus* Tullberg, until I found the peculiar sense organs of the third antennal segment. In *viaticus*, of which I have many European specimens, the sense organ of the third antennal segment is as in figure 19, with a pair of sense rods, a single finger-like accessory seta, and one guard seta. In this new species there are, however (fig. 13), two pairs of sense rods, each pair with the usual basal ridge; also a distal ovate petiolate papilla, seated in a pit and covered basally with an integumentary fold; and in addition as many as nine lanceolate accessory sensory setæ, with five guard setæ—a wide departure from the condition typical for the genus. The other differences between the two species are of minor importance. In *sensilis*, as compared with *viaticus*, there are not three long knobbed tenent hairs; the tenaculum is not quadridentate; and the anal spines are somewhat shorter, stouter, and less curving. The clothing is of the same general type in the two species; the stout suberect setæ of the body being, however, somewhat shorter than in *viaticus* (compare fig. 18 with fig. 20).

This species occurred in masses on the surface of a pond at Bernard harbour, Northwest Territories, July 5, 1916. F. Johansen

Achorutes armatus (Nicolet).

Plate 3, figs. 21–25.

Podura armata Nicolet, 1841.

Achorutes armatus Gervais, 1844.—Nicolet, 1847.—Lubbock, 1868–1873.—Tullberg, 1871, 1872, 1876.—Parona, 1879, 1882, 1888, 1895.—Tomosvary, 1883.—Oudemans, 1890.—Uzel, 1890, 1891.—MacGillivray, 1891.—Schott, 1891, 1894, 1896, 1902.—Moniez, 1894.—Dalla Torre, 1895.—Reuter, 1895.—Meinert, 1896.—Schäffer, 1896, 1897, 1900a, 1900b.—Carpenter, 1897.—Lie-Pettersen, 1896, 1898.—Poppe and Schäffer, 1897.—Scherbakov, 1898b, 1899a.—Carl, 1899, 1901.—Carpenter and Evans, 1899.—Wahlgren, 1900a.—Börner, 1901a.—Krausbauer, 1902.—Willem, 1902.—Agren, 1903, 1904.—Axelson, 1905a, 1905b, 1906.—(Axelson) Linnaniemi, 1907, 1909.—Collinge and Shoebotham, 1910.—Imms, 1912.—Shoebotham, 1914.—Folsom, 1916.

Achorutes boletivorus Packard, 1873.—MacGillivray, 1891.—Dalla Torre, 1895.—Guthrie, 1903.

Achorutus marmoratus Packard, 1873.—MacGillivray, 1891.—Harvey, 1893.

Achorutes texensis Packard, 1873.—MacGillivray, 1891.—Dalla Torre, 1895.

Achorutes pratorum Packard, 1873.—MacGillivray, 1891.—Dalla Torre, 1895.

Hypogastrura armata (Axelson) Linnaniemi, 1911, 1912.—Caroli, 1914.

Very variable in colouration. General colour vinaceous, pale violet, greenish grey, or dark blue. One variety is canary yellow marbled with lavender, with two dorsal stripes of the latter colour. The dorsum is commonly mottled or marbled, and the pleura and sternum are pale yellow with round spots made by hypodermal nuclei. A large interocular spot occurs. Ocular patches conspicuous, black. Eyes eight on each side. Postantennal organs (fig. 21) large, with four unequal peripheral tubercles. Antennæ shorter than the head; segments in relative lengths as 5:4:5:6; fourth segment with seven sensory hairs: two outer, two inner, and three dorsal. Between the third and fourth antennal segments is a large ventral eversible bilobed sac. Body stout; abdomen feebly dilated. Unguis (fig. 22) long, slender, slightly curving, unidentate near the middle of the inner margin; lateral margins each unidentate one-fourth from the base. Unguiculus with suboblong basal lamella and setaceous apex, extending almost as far as the tooth of the opposite claw. One long tenent hair, unknobbed. Dentes stout, subcylindrical. Mucrones (fig. 23) half as long as dentes, apically rounded; inner lamella narrow, simple; outer lamella with a large subtriangular dorsal lobe. Anal spines (fig. 24) long, a little longer than the ungues in adult specimens, slender, curving, on large contiguous papillæ, which are one-third to one-half as long as the spines. Clothing (fig. 25) dense, consisting of abundant short setæ and numerous long hairs and setæ, which are frequently serrate. Length, 1.5 mm.

The synonymy of this species I have discussed in a previous paper (Folsom, 1916).

The specimens collected by the Expedition were all of the dark blue variety.

Achorutes armatus, one of the most abundant species of its genus, occurs in large colonies in a great variety of situations; under the loose moist bark of logs, on damp soil under wood or dead leaves, underground among the roots of grasses or other plants, in moss, on pools of fresh water. This species is the one commonly found on fungi, particularly agaries, though it occurs on *Boletus*, *Polyporus*, *Morchella* and other genera as well.

This is one of the most widely distributed species of Collembola. It occurs in all parts of Europe, in Siberia, Spitzbergen, Greenland, Northern Africa (Tripoli), Sumatra, Ceylon, New Zealand, Brazil, Paraguay, Uruguay, Chile, and doubtless throughout the United States. In Canada it has been taken at Arnprior, Ont., in September, by Mr. Charles Macnamara.

Several specimens on ponds, Bernard harbour, Northwest Territories, May 25, 1916; June 18, 25, 1915. Abundant in moss in swamp, Pihumalerksiak island (Cockburn point), Dolphin and Union strait, Northwest Territories, July 15, 1916. F. Johansen.

Onychiurus duodecimpunctatus, n. sp.

Plate 3, figs. 26-30; plate 4, figs. 31, 32.

White. Postantennal organs (fig. 26) elongate, with simple tubercles numbering 32 in one example and 44 in another. Pseudocelli of antennal bases (fig. 27) 6 + 6 (two specimens) or 5 + 5 (one specimen); of posterior border of head 4 + 4 (two specimens) or 5 + 5 (one specimen). Antennæ subequal to head in length. Sense organ of third antennal segment (fig. 28) with five papillae, five guard setae, a pair of sense rods, and two capitate tuberculate sense clubs. Pseudocelli of body (fig. 29) as follows—Prothorax: dorsal, 0; lateral, 1 + 1. Mesothorax: dorsal, 2 + 2; lateral, 1 + 1. Metathorax: dorsal, 2 + 2; lateral, 1 + 1. First abdominal segment: dorsal, 4 + 4. Second abdominal, 4 + 4 (two specimens) or 5 + 5 (one specimen). Third, 5 + 5 (2 spms.) or 4 + 4 (1 spm.). Fourth, 6 + 6 (2 spms.) or 5 + 5 (1 spm.). Fifth, 5 + 5 (2 spms.) or 4 + 4 (1 spm.). Sixth, 0.

Unguis (fig. 30) slender, curving, unidentate beyond the middle of the inner margin. Unguiculus exceeding the unguis, slender, gradually tapering from the base into a fine filament. Anal spines (fig. 31) two, feebly curving, half as long as hind ungues, on separated papillae, one-fourth as long as the spines. Clothing (fig. 32) of short curving simple setæ, with long erect simple sensory setæ. Length, 2.4 mm.

This species belongs near the common *armatus* Tullberg, and comes nearest to *octopunctatus* Tullberg, a rarely recorded species that has never been fully described. If the form here described proves to agree with *octopunctatus* in respect to pseudocelli and the minute structure of the antennal sense organs, it should be regarded as a variety of that species.

Three cotypes, from rotten driftwood at Bernard harbour, Northwest Territories, June 19, 1915. F. Johansen.

Tetracanthella wahlgreni Axelson.

Plate 4, figs. 33–37; plate 5, figs. 38–41.

Tetracanthella pilosa Schött, 1894 (part), 1902 (part).—Lie-Pettersen, 1896. Wahlgren, 1899b, 1900b, 1906b.—Axelson, 1900.

Tetracanthella coerulea Schäffer, 1900a, 1900b.

Tetracanthella wahlgreni (Axelson) Linnaniemi, 1907, 1912. Bagnall, 1914.

Dark blue. Body elongate, narrowing posteriorly (fig. 33). Eyes on black patches, 8 + 8 (fig. 34); the two inner proximal eyes of each side smaller than the others; the three posterior eyes in a group apart from the five anterior. Postantennal organs (fig. 34) elongate, subelliptical, eight or nine times as long as broad, and four times as long as the diameter of an adjacent eye; sometimes constricted near the middle. Antennæ shorter than the head, with segments in relative lengths about as 9:13:10:19. Sense organ of third antennal segment (fig. 35) consisting of a pair of slender curving sense rods, subtended by a thick chitinousridge, and covered with an integumental fold. Fourth antennal segment with subapical papilla and with slender curving sensory setae. Second, third, and fourth abdominal segments subequal in length dorsally. Genital and anal segments confluent, bearing two pairs of spines (figs. 36, 37). Posterior spines a little longer than hind ungues, feebly curving, on stout papillae almost half as long as the spines. Anterior spines similar to the posterior, but a little shorter. Ano-genital segment with long stiff hairs projecting beyond the apex of the abdomen, which are simple in some specimens but apically bent and knobbed in others. Anus ventral. Unguis stout, untoothed (fig. 38). Unguiculus extending half to three-fifths as far as the unguis, lanceolate, acuminate. Clavate tenent hairs two, extending as far as, or farther than, the unguis. Femur with a single long clavate hair (fig. 33). Furcula short, appended to the fourth abdominal segment, and extending to the posterior margin of the third. Manubrium stout, with several pairs of dorsal setæ (fig. 39). Mucro and dens not demarkated from each other. Mucro-dentes convergent, in form as in figs. 39 and 40; each with three setæ: two dorsal and one ventral. Rami of tenaculum bidentate (fig. 39); corpus with a single stout seta. General clothing of few short equal curving simple setæ in the middle region of each segment, with long outstanding simple sensory setæ in a single transverse series on most of the body segments (fig. 41). Cuticula not tuberculate, but figured. Length, 1.8 mm.

The term *figured*, as applied to the cuticula, means that the integument is divided into minute polygonal areas.

In two specimens the long distal hairs of the abdomen were simple; in one specimen, however, they were distinctly bent apically, with a minute terminal knob, as in my fig. 36. Linnaniemi ('12, p. 104), not having seen these clavate hairs as described by Schött, suggested that the appearance of terminal knobs was due to adherent particles of foreign matter.

As Linnaniemi ('12, p. 102) has shown, the original descriptions of *Tetracanthella pilosa* by Schött were based upon two distinct species; now known respectively as *pilosa* and *wahlgreni*. The specimens that I have studied agree accurately with the description and figures given by Linnaniemi of the latter species.

He says that in Finland *T. wahlgreni* lives under moss and lichens, as well as under stones, on the rocky summits of the mountains, where it may almost always be found, not infrequently in considerable numbers. Sometimes it can be taken also on the surfaces of pools of water. It has made its appearance early in summer, before the snows have melted on the mountain tops. Common as the species is on the summits of the mountains, it is seldom found in the timber region, but oftener, however, in the subalpine zone.

T. wahlgreni has been reported from Norway, Sweden, Finland (north of the Arctic circle), Spitzbergen and Bear island, and is essentially Arctic in its distribution.

Four specimens (one spoiled by dissection), on the surface of a pond in a swamp, Bernard harbour, Northwest Territories, June 18, 1915. F. Johansen.

Folsomia quadrioculata (Tullberg).

Plate 5, figs. 42-47.

Isotoma quadrioculata Tullberg, 1871, 1872, 1876.—Stuxberg, 1887.—Uzel, 1890.—MacGillivray, 1891, 1896.—Moniez, 1891.—Schött, 1894, 1902.—Dalla Torre, 1895.—Reuter, 1895.—Lie-Pettersen, 1896, 1898, 1907.—Meinert, 1896.—Schäffer, 1896, 1900a, 1900b.—Poppe and Schäffer, 1897.—Lubbock, 1898.—Scherbakov, 1898a, 1898b.—Carl, 1899, 1901.—Wahlgren, 1899b, 1900a, 1900b, 1906a, 1906b.—Absolon, 1900.—Skorikow, 1900.—Börner, 1901a.—Krausbauer, 1902.—Agren, 1903, 1905.—Guthrie, 1903.—Axelson, 1904, 1905b, 1906.—Evans, 1908.

Isotoma (*Folsomia*) *quadrioculata* Axelson, 1905a.

Folsomia quadrioculata (Axelson) Linnaniemi, 1907, 1909, 1911, 1912.—Collinge and Shoebotham, 1910.

Dull grey to greyish black, pigmented with blackish spots of irregular form, size and distribution. Small specimens may be white, or white with scattered spots of greyish blue. Large specimens are often blackish, mottled with white, or unpigmented, spots; pale across the intersegmental regions and ventrally; with antennæ, legs and manubrium pigmented, and dentes unpigmented. Eyes 2 + 2 (fig. 42), one behind the other, each with its separate pigment spot, the posterior eye being the smaller. Postantennal organs (fig. 42) long, narrow, with parallel sides, feebly curving. Antennæ varying from a little shorter to a little longer than the head; second segment a little longer than the third; fourth segment two to three times as long as the first. Sense organ of third antennal segment as in fig. 43. Fourth antennal segment with slender curving sensory setæ, much like the other setæ. Body stout. Fourth, fifth, and sixth abdominal segments ankylosed; with a trace of a dorsal suture between the fourth and fifth segments. Anus ventro-caudal. Unguis (fig. 44) stout, curving, simple, without teeth. Unguiculus small, extending a little less than half as far as the unguis, lanceolate, pointed, untoothed. Tenent hairs absent. Furcula appended to the fourth abdominal segment, short, extending almost to the posterior margin of the second abdominal segment. Manubrium (fig. 45) with two pairs of ventro-apical chitinous hooks between the bases of the dentes. Dentes (fig. 46) stout, slightly tapering, with a few crenulations near the middle of the dorsal region. Mucrones (fig. 46) bidentate; apical tooth hooked; anteapical tooth usually larger than the other, erect or curving slightly forward. Rami of tenaculum quadridentate; corpus with a single stout curving seta. Clothing of simple setæ (fig. 47) of three kinds: (1) moderately long stiff dense setæ,

slanting backward: absent on the anterior and posterior regions of the intermediate body segments; (2) fewer setæ, suberect or curving forward; (3) long slender outstanding sensory setæ. Length, 1.5 mm.

The specimens collected by the Expedition agree with my European examples of the species.

Folsomia quadrioculata occurs on damp ground under stones, wood or fallen leaves, in humus and in moss, under loose bark, in flower pots, and on the seashore under driftwood, stones or seaweed. The species is easily recognized by its broad body, characteristic dirty grey colour and slow movements. When disturbed it springs actively, in spite of its short furcula. In Finland it winters full grown and comes to life now and then on mild days; never appearing on the snow, however, but remaining among leaves or in moss in the woods (Linnaniemi, '12).

This species, one of the commonest collembolans in northern and middle Europe, has been reported from the following Arctic localities: Nova Zembla, Spitzbergen, King Charles land, White island, Bear island, Jan Mayen and Greenland.

From Canada, I have received specimens recently from Mr. Charles Macnamara, taken by him in dead leaves, October, 1917, at Arnprior, Ont.

In the United States, the species has been recorded from Minnesota by Guthrie, some of whose specimens I have studied through the courtesy of Prof. Henry F. Nachtrieb.

Bernard harbour, Northwest Territories, on the surface of a pond, June 18, 1915 (2 specimens), July 9, 1915 (1 specimen). F. Johansen.

Isotoma viridis Bourlet.

Plate 6, figs. 48–52.

Isotoma viridis Bourlet, 1839.—Gervais, 1844.—Nicolet, 1847.—Lubbock, 1873.—Parona, 1879, 1883.—Schött, 1891, 1894, 1902.—Dalla Torre, 1895. Reuter, 1895.—Lie-Pettersen, 1896, 1898, 1907.—MacGillivray, 1896.—Meinert, 1896.—Schäffer, 1896, 1900a, 1900b.—Poppe and Schäffer, 1897.—Scherbakov, 1898a, 1898b, 1899a.—Carl, 1899, 1901.—Absolon, 1900.—Carpenter and Evans, 1899.—Evans, 1901a, 1901b.—Wahlgren, 1899a, 1899b, 1900a, 1900b, 1906a, 1906b, 1907, 1909.—Kieffer, 1900.—Skorikow, 1900.—Willem, 1900. Börner, 1901a, 1903, 1906.—Folsom, 1902.—Krausbauer, 1902.—Voigts, 1902. Ågren, 1903, 1904.—Axelson, 1903, 1904, 1905a, 1906.—(Axelson) Linnaniemi, 1907, 1909, 1911, 1912.—Guthrie, 1903.—Carpenter, 1907.—Collinge, 1910. Collinge and Shoebotham, 1910.—Shoebotham, 1914.

Isotoma caerulea Bourlet, 1839.—Gervais, 1844.
Desoria virescens Nicolet, 1841.—Gervais, 1844.
Desoria cylindrica Nicolet, 1841.—Gervais, 1844.
Desoria viatica Nicolet, 1841.—Gervais, 1844.
Desoria pallida Nicolet, 1841.—Gervais, 1844.
Desoria ebriosa Nicolet, 1841.—Gervais, 1844.
Desoria annulata Nicolet, 1841.—Gervais, 1844.
Podura viridis Bourlet, 1843.
Podura annulata Bourlet, 1843.
Heterotoma chlorata Gervais, 1844.
Isotoma Desmarestii Gervais, 1844.
Isotoma virescens Nicolet, 1847.
Isotoma cylindrica Nicolet, 1847.
Isotoma viatica Nicolet, 1847.
Isotoma ebriosa Nicolet, 1847.
Isotoma annulata Nicolet, 1847.—Lubbock, 1873.—Parona, 1883.
Isotoma anglicana Lubbock, 1862, 1873

Isotoma palustris Tullberg, 1871, 1872, 1876.—Uzel, 1890.
Isotoma Belfragei Packard, 1873.—MacGillivray, 1891.
Isotoma tricolor Packard, 1873 (part).—MacGillivray, 1891 (part).
Isotoma purpurascens Packard, 1873.—MacGillivray, 1891.
Isotoma plumbea Packard, 1873.—MacGillivray, 1891.
Isotoma capitola MacGillivray, 1896.
Isotoma glauca MacGillivray, 1896.

Colour very variable: dark green, greenish yellow, dull yellow, lilac, blackish blue, reddish purple, leaden purple or dark brown; usually with small pale dorsal spots. Without longitudinal lines, in the typical form. Eyes 8 + 8, subequal (fig. 48). Postantennal organs (fig. 48) broadly elliptical, oval, or circular; shorter, to a little longer, than the diameter of an eye. Antennæ one and one-half to two times as long as the head, with segments in relative lengths about as 4:7:7:8. Sense organ of third antennal segment consisting of a pair of slender rods. Abdominal segments without ankylosis. Fourth abdominal segment slightly shorter than the third. Ungues (fig. 49) long, slender, slightly curving, with a pair of large lateral teeth, with inner margin bidentate, and with parallel basal folds. Unguiculus extending two-fifths to two-thirds as far as unguis, lanceolate, unidentate near the middle of the inner margin. Tenent hairs absent. Furcula strongly developed, appended apparently to the fifth abdominal segment. Dentes slender, gradually tapering, more than twice as long as manubrium, crenulate dorsally, with a distal bristle extending beyond the mucro. Mucrones (fig. 50) falcately and subequally tridentate; second and third teeth opposite each other. Rami of tenaculum quadridentate (fig. 51); corpus with numerous ventral setæ. Clothing (fig. 52) of dense simple or feebly serrate setæ; with long outstanding fringed sensory setæ. Maximum length, 6 mm. (typical form); 7 mm. (var. *arctica*).

The specimens of this well-known species collected by the Expedition agree with my examples from Europe and the United States, but are under the maximum size, being not more than 3 mm. in length. In colour they are clear green with pale spots, or dark blue.

Having examined Packard's types in the Museum of Comparative Zoölogy, Cambridge, Mass., I agree with MacGillivray ('96, p. 58) that *Isotoma Belfragei*, *purpurascens*, *plumbea*, and the Massachusetts specimens of *tricolor*, all belong to *viridis* Bourlet. The Texas specimens, for which MacGillivray retained the name of *tricolor*, are *palustris* Müller.

Isotoma capitola MacG. is synonymous with *viridis* Bourl., as I have found from a cotype sent to me by MacGillivray.

The form referred by MacGillivray to *glauca* Packard is also *viridis* Bourl., and is specifically distinct from Packard's *glauca*.

Isotoma viridis is one of the most abundant collembolans, is the largest known species of its genus in North America and Europe, and may easily be recognized with the naked eye. It belongs primarily to the fauna of the humus, and occurs in almost any soil that is not too dry—in grass lands, woods, swamps, or cultivated fields—congregating under stones, pieces of wood, dead leaves or other protection, and in piles of garbage or manure. It occurs in moss, on pools of water, on the seashore under driftwood or seaweed, and in winter on the snow.

The typical form of *Isotoma viridis*, ranging throughout Europe and the United States, including Alaska, has been reported from the following Arctic localities: Siberia, Spitzbergen, Bear island, Jan Mayen, Iceland and Greenland.

One specimen under old drift-wood logs in tundra behind house at Collinson Point, Alaska, Sept 27, 1913. F. Johansen.

Two specimens, under driftwood, Demarcation point, Alaska, May 16, 1914. F. Johansen.

A few specimens, under loose stones, Bernard harbour, Northwest Territories, May, 1915. F. Johansen.

Isotoma viridis var. **riparia** Nicolet.

Desoria riparia Nicolet, 1841.—Gervais, 1844.
Isotoma riparia Nicolet, 1847.
Isotoma palustris var. *riparia* Tullberg, 1871.
Isotoma palustris Tullberg, 1872 (part).
Isotoma viridis var. *aquatilis* Schött, 1891.
Isotoma viridis var. *riparia* Schött, 1894, 1896, 1902. –Dalla Torre, 1895.—Reuter, 1895.—Schäffer, 1896, 1900a.—Poppe and Schäffer, 1897.—Lie-Pettersen, 1898.—Scherbakov, 1898a, 1898b.—Carl, 1899. –Wahlgren, 1899a, 1906a, 1906b.—Absolon, 1900.—Börner, 1901a.—Voigts, 1902. –Agren, 1903, 1904. Axelson, 1903, 1905a, 1906.—(Axelson) Linnaniemi, 1907, 1909, 1911, 1912.

Ground colour yellowish, greenish or brownish. The principal characteristic of this variety is a dark blue or blackish median dorsal stripe. Dark spots on the sides of the body segments may or may not be present. Maximum length, 5 mm.

The specimens of *I. viridis riparia* collected by the Expedition are yellowish or greenish, pale ventrally, with or without the lateral dark spots and with the median stripe complete, or fading out posteriorly. Length, 2.5 mm.

This variety prefers humid situations, and is found under damp wood, in moss, on the surface of fresh water, along the shores of ponds or streams and on the seashore under seaweed, driftwood or stones.

The variety *riparia* ranges over north and middle Europe, and has been recorded from Arctic Siberia.

In Canada, Mr. Charles Macnamara has taken this variety at Arnprior, Ont., in March and April.

In the United States, the variety is known to me from New Hampshire, New York, Virginia, and Texas, at present.

A few specimens under loose stones, Bernard harbour, Northwest Territories, May, 1915. F. Johansen.

Isotoma palustris (Müller).

Plate 6, figs. 53-57.

Podura palustris Müller, 1776.–Gmelin, 1778-93.—Bourlet, 1843.
Isotoma palustris Lubbock, 1873.—Reuter, 1876 (part), 1890, 1891, 1895. –Reuter, L. and O. M., 1880.—Tömösváry, 1882.—Parona, 1885, 1895.—Oudemans, 1888.—Dalla Torre, 1888, 1895.—Uzel, 1890, 1891.—Parfitt, 1891.—Schött, 1891, 1894, 1896, 1902.—Lie-Pettersen, 1896, 1898, 1907.—MacGillivray, 1896.—Schäffer, 1896, 1898, 1900a, 1900b.—Poppe and Schäffer, 1897.—Scherbakov, 1898a.—Carl, 1899, 1901.—Carpenter and Evans, 1899.—Absolon, 1900.—Börner, 1901a, 1902.—Krausbauer, 1902.—Agren, 1903.—Guthrie, 1903. Wahlgren, 1906b, 1907.—Collinge, 1910.—Collinge and Shoebotham, 1910.—Shoebotham, 1914.
Isotoma tricolor Packard, 1873 (part).—MacGillivray, 1891 (part), 1896.
Isotoma aquatilis Lubbock, 1873 (part).—Parona, 1883.
Isotoma Stuxbergii Tullberg, 1876 (part).
Isotoma Tullbergi Moniez, 1889.
Isotoma Stuxbergi Moniez, 1891.
Isotoma aequalis MacGillivray, 1896.
Isotomurus palustris Börner, 1903, 1906.—Axelson, 1905a, 1906.—(Axelson) Linnaniemi, 1911, 1912.—Imms, 1912.

Very variable in colouration. The typical form is yellowish or greenish with blue, purple or blackish pigment; having a median dorsal stripe with irregular margins; and frequently lateral spots, which may coalesce to form a stripe on each side of the body. Head often with a dorsal lunate or anchor-

shaped spot. Eyes 8 + 8 (fig. 53) subequal; or two inner proximal eyes of each group a little smaller than the others. Postantennal organs (fig. 53) near the eyes, elliptical, slightly longer than, to twice as long as, the diameter of an adjacent eye. Antennæ once and one-half to twice as long as the head, with segments in relative lengths about as 3:4:5:6. Sense organ of third antennal segment with a pair of linear feebly curving sense rods, a thick basal ridge, and two guard setæ. Very short curving sensory setæ occur on all the antennal segments as follows: segment 1, 2-5; 2, 3-7; 3, 3-7; 4, 10-15. On the first three segments these are on the under side near the distal outer end; on the fourth segment they occur on the distal half along the outer side (Ågren, '02). Mesonotum almost covering the pronotum. Third abdominal segment a little longer than the fourth (about as 5:4). Abdominal segments without ankylosis. Unguis (fig. 54) stout, curving, with a pair of small lateral teeth, and with inner margin untoothed. Unguiculus broadly lanceolate, with inner lamella roundly dilated basally, untoothed as a rule, extending a little beyond the middle of the unguis. Tenent hairs absent, represented by a single long simple hair. Furcula apparently appended to the fifth abdominal segment, and extending to the anterior border of the ventral tube. Dentes twice as long as manubrium, slender, gradually tapering, crenulate dorsally. Mucro two-thirds as long as hind unguis, quadridentate (fig. 55). Apical tooth small, at the base of the second tooth; second and third teeth dorsal, large, subequal, subconical, slightly hooked, in longitudinal alinement; fourth tooth lateral, oblique, acute, extending almost half the length of the mucro. Basal lateral mucronal seta present. Rami of tenaculum quadridentate (fig. 56); corpus with many (fifteen or more) ventral setæ. General clothing of abundant short simple setæ (fig. 57). Long outstanding feathered sensory setæ occur on the last five abdominal segments; there being one or two pairs of these on each of the segments, and sometimes three pairs on the fourth abdominal segment. Length, 3 mm.

Packard's six cotypes of his *Isotoma tricolor*, from Waco, Texas, in the Museum of Comparative Zoölogy, Cambridge, Mass., for which MacGillivray ('96, p. 48) retained the name of *tricolor*, I found to be *palustris*. In the same tube with them were five specimens of *Isotoma viridis*, from Salem, Mass.

I. aequalis MacG. is also *palustris*, as I have found from a study of a cotype sent to me by MacGillivray.

Isotoma palustris lives in moist places, and is especially abundant along the edges of ponds and streams, frequenting the vegetation in preference to the water, though it is at home on the surface of the water, where it leaps vigorously and repeatedly. The species occurs on the seashore also, under seaweed, driftwood or stones, and is sometimes found on the snow.

This is one of the dominant species of its order. It is cosmopolitan in distribution, everywhere common, and highly variable in colouration, several varieties having received names. The typical form of the species is known from all parts of Europe, from Canada and the United States, Azores islands, India, and Java; the recorded Arctic distribution being as follows: Siberia, Nova Zembla, Spitzbergen, Bear island.

Isotoma palustris var **prasina** Reuter.

Plate 6, figs. 53–57.

Isotoma Stuxbergi var. *prasina* Reuter, 1891.

Isotoma palustris var. *prasina* Schött, 1894.—Dalla Torre, 1895. -Reuter, 1895.—MacGillivray, 1896. -Schäffer, 1896, 1898, 1900a, 1900b. -Poppe and Schäffer, 1897. - Carl, 1899, 1901. -Carpenter and Evans, 1899.—Wahlgren, 1899c, 1906b. Börner, 1901a.- Krausbauer, 1902.—Agren, 1903.

Isotoma palustris var. *patlida* Schäffer, 1896.- Börner, 1901a.—Krausbauer, 1902.

Isotomurus palustris var. *prasina* Axelson, 1905a, 1906. Wahlgren, 1907. (Axelson) Linnaniemi, 1907, 1911, 1912.

Yellowish green or pale yellowish, varying sometimes into yellowish red or brownish; unicolorous, or with a trace of the median dorsal stripe. Length as great as 4.5 mm.

The specimens collected by the Expedition are uniform olive green in colour, with paler furcula. In some specimens the median dorsal stripe is represented, varying from a mere trace to a well-developed line, on head and body. In some instances the posterior borders of the body segments are edged narrowly with blackish. Maximum length, 3 mm.

These specimens, which I feel obliged to refer to the species *palustris*, differ from typical European and North American examples of the species in having more slender ungues, relatively shorter mucrones, unidentate unguiculi, and particularly in lacking the characteristic long fringed sensory setæ. Furthermore, some of the largest of the curving body-setæ are feebly denticulate. In other respects the specimens agree with *palustris*, as is evident from my figs. 53–57.

The variety *prasina* has been recorded from northern and middle Europe, Bismarck archipelago, Siberia, Nova Zembla, and Ellesmere land.

Many specimens: on ponds at Bernard harbour, Northwest Territories, May 25, 1916, June 16, 18, 25, July 9, 1915; under driftwood, Demarcation point, Alaska, May 16, 1914. F. Johansen.

Entomobrya comparata, n. sp.

Plate 7, figs. 58–63

This form, like most other species of its genus, varies greatly in colouration. Though the colour varieties intergrade, I have placed them in the following three groups for the purposes of description:

(1) Pale lemon yellow, including antennæ and legs; furcula white. Eyespots black; also basal antennal ring and a transverse band connecting the eyespots and the bases of the antennæ.

(2) Lemon yellow, with black antennal rings and intercelular band, and black median suberescentic spot behind the eyes (fig. 58). Anal segment black dorsally. Antennæ purplish distally. Legs and furcula yellow. This is the commonest form in the collection.

(3) General colour brownish yellow, faintly and minutely mottled with pigment. Segments bordered narrowly with black, as well as the posterior border of the fourth abdominal segment, as in fig. 59. Anal and genital segments black dorsally. Fourth and fifth abdominal segments with a variable amount of pigment ventrally. First antennal segment blackish apically; remaining segments blackish. Femora and tibio-tarsi pigmented distally, and the manubrium dorsally.

Eyes 8 + 8, unequal (fig. 60). Antennæ a little more than twice as long as the head, with segments in relative lengths about as 4:10:9:12. Abdominal segments in relative lengths as 13:19:14:40:6:4. Fourth abdominal segment therefore about three times as long as the third. Unguis (fig. 61) with a pair of lateral teeth and with inner margin tridentate in profile; all three teeth being actually doubled, however. Ungaiculus extending a little beyond the middle of the unguis, broadly lanceolate, simple. One clavate tenent hair. Dentes one third longer than manubruim. Mucrones half as long as hind unguiculi, of the usual form (fig. 62). Rami of tenaculum quadridentate; corpus with one stout curving seta (fig. 63). General clothing of dense short curving fringed setæ. Dorsum of head and body with dense clavate fringed setæ, less abundant on the last three abdominal segments. Antennæ and legs densely setaceous. A few long fringed sensory setæ occur as usual. Length, 1.7 mm.

It is possible that this form is simply a variety of one of the numerous described species of *Entomobrya*, though it does not agree accurately with any published description that I have seen, or with any of the numerous European species in my collection.

Several specimens under driftwood on tundra, Demarcation point, Alaska, May 16, 1914. F. Johansen.

Many specimens under loose stones, Bernard harbour, Northwest Territories, May 1915. F. Johansen.

Lepidocyrtus cyaneus Tullberg.

Plate 7, figs. 64-66.

Lepidocyrtus cyaneus Tullberg, 1871, 1872, 1876. Reuter, 1876. Reuter, L. and O. M., 1880. Moniez, 1891.—Schött, 1894, 1902. Dalla Torre, 1895.—Lie-Pettersen, 1896, 1898, 1907. Schäffer, 1896, 1900a, 1900b. Poppe and Schäffer, 1897. Scherbakov, 1898a, 1898b. Carl, 1899, 1901. Carpenter and Evans, 1899.—Börner, 1901a.—Krausbauer, 1902. Voigts, 1902. Axelson, 1903, 1904, 1905a, 1906.—Agren, 1903, 1904. Wahlgren, 1906a, 1906b.—Carpenter, 1907.—Collinge and Shoebotham, 1910. (Axelson) Linnaniemi, 1907, 1911, 1912.

Lepidocyrtus purpureus Lubbock, 1873. Oudemans, 1887. Reuter, 1890, 1895.—Uzel, 1890.—Parfitt, 1891.—Guthrie, 1903.

Lepidocyrtus violaceus Lubbock, 1873. Parona, 1882, 1888. Oudemans, 1887.—Uzel, 1890, 1891.—Tömösváry, 1883.

Lepidocyrtus metallicus Packard, 1873.—MacGillivray, 1891.

Lepidocyrtus assimilis Reuter, 1890, 1895.—Schäffer, 1898.

Lepidocyrtus pallidus Schött, 1893.—Reuter, 1890, 1895. Lie-Pettersen, 1896.—(Axelson) Linnaniemi, 1912.

Lepidocyrtus cyaneus var. *pallidus* Schött, 1894.—Wahlgren, 1906.

Lepidocyrtus cyaneus var. *assimilis* Schött, 1894.—Dalla Torre, 1895.—Wahlgren, 1908.

Lepidocyrtus elegantulus Meinert, 1896.

Dark blue or violet with iridescent scales. Denuded of scales, dull blue or violet. Legs yellow beyond the coxae; dentes or entire furcula yellow; first and second antennal segments yellow with purple apices; third and fourth antennal segments purple; dorsum of head, and sometimes the mesonotum, yellow; fifth and sixth abdominal segments and the anterior region of the fourth often yellow. Narrow yellow intersegmental bands are often present. The unpigmented regions may be white instead of yellow. Body stout. Mesonotum arched, concealing the pronotum and projecting moderately over the head. Eyes (fig. 64) 8 + 8, on black patches; the two inner proximal eyes of each group smaller than the others. Antennæ one-fourth to one-half longer than the head. Antennal base black. Second and third antennal segments subequal in length; fourth segment one-half to two-thirds longer than the third. Unguis (fig. 65) with a pair of large lateral teeth, and with two pairs of inner teeth, the proximal pair being at the middle of the inner margin. Unguiculus narrow, sublanceolate, pointed, untoothed, extending three-fifths as far as the unguis on the third pair, and about half as far on the first and second pairs of feet. One clavate tenent hair. Fourth abdominal segment three to four times as long as the third. Dentes a little longer than the manubrium. Mucro (fig. 66) about as long as hind unguiculus, with long apical tooth and well developed basal spine. Anterior region of head with short stiff fringed clavate setæ. Anterior border of mesonotum with a dense cluster of stiff clavate setæ. Antennæ, legs and posterior region of abdomen with dense fringed setæ. Dentes with two dorsal rows of subclavate fringed setæ. Manubrium and dentes scaly, the ventral scales more numerous than the dorsal. Length, 1 mm.

The preceding description is based upon numerous specimens of typical *L. cyaneus* from Europe and the United States.

Packard's *L. metallicus* is this species, as I have found by a study of his cotypes in the Museum of Comparative Zoölogy, Cambridge, Mass.

The specimens of this species collected by the Expedition are all typical as regards structural details, but most of them are atypical in respect to colouration. Thus, in a heavily pigmented specimen, all four antennal segments are yellow; and most of the denuded specimens are olivaceous, the effect of the yellow ground colour in combination with minute spots of violet pigment.

L. cyaneus is primarily a species of the humus, but occurs also in other situations, as under loose dead bark or in moss. The species is common under sticks or stones on the ground, and is often found on soil that is too dry for the existence of collembolans without scales.

Lepidocyrtus cyaneus has been reported from northern Siberia, Greenland, most parts of Europe, the United States, Africa (Egypt, Kamerun, German East Africa) and the Bismarck archipelago.

Nine specimens, under driftwood on higher, dry tundra, Demarcation point, Alaska, May 16, 1914. F. Johansen.

Sminthurides aquaticus (Bourlet).

Plate 8, figs. 67–72.

Smynthurus aquaticus Bourlet, 1843.—Lubbock, 1873. Oudemans, 1887. Uzel, 1890.

Sminthurus apicalis Reuter, 1880.—Levander, 1894.

Smynthurus apicalis Uzel, 1890.

Sminthurus aquaticus Reuter, 1891, 1895.—Schött, 1894.—Lie-Pettersen, 1896, 1898.—Schäffer, 1896.—Poppe and Schäffer, 1897.—Scherbakov, 1898a, 1898b.—Carl, 1899.—Krausbauer, 1902.—Evans, 1908.

Smynthurus amicus Folsom, 1896.

Sminthurus (Sminthurides) aquaticus Börner, 1900.

Prosminthurus aquaticus Willem, 1900.

Sminthurides aquaticus Börner, 1901a, 1906.—Agren, 1903.—Axelson, 1904, 1905a.—Wahlgren, 1906a.—1906b.—Lie-Pettersen, 1907.—(Axelson) Linnaniemi, 1907, 1909, 1911, 1912.—Collinge, 1910.—Collinge and Shoebotham, 1910.

General colour yellow, brownish yellow, greenish, rose, or violet. Eye-spots large, black. Eyes 8 + 8, two in each group being smaller than the others (fig. 67). Antennæ purple, slightly longer than the head, with fourth segment not subsegmented. Antennæ of male with second and third segments modified to form clasping organs. Abdomen segmented dorsally. Unguis of first and second feet (fig. 68) slender, with inner margin unidentate a little beyond the middle; unguiculus extending two-thirds as far as the unguis, lanceolate, acute, with a subapical filament as long, to twice as long, as the claw proper, and extending often a little beyond the unguis. Ungues of third feet (fig. 69) three-fourths as long as those of the other feet, slender, feebly curving, without teeth; unguiculus extending not quite as far as the unguis, broadly lanceolate, untoothed, with apical filament exceeding the unguis. Tenent hairs absent. Third tibio-tarsi with a peculiar distal sense organ (fig. 69) consisting of a pair of slipper-shaped structures, with a stout seta extending beyond the tibio-tarsus. Ventral tube emitting a pair of short rounded sacs. Furcula reaching beyond the mouth. Dentes three times as long as mucrones. Mucrones convergent, spoon-like in general form (figs. 70,71) elliptical from above, with stout pigmented midrib, and three colourless lamellæ as follows: (1) inner dorsal, with radiating ribs terminating in marginal teeth; (2) outer dorsal, with faint radiating ribs due to dorsal ridges, but with entire margin; (3) ventral lamella, narrow and entire. Basal lateral mucronal seta present. Rami of tenaculum tridentate (fig. 72);

corpus with a large anterior lobe extending below the rami, and bearing a pair of long anterior setæ and a pair of short apical setæ. Clothing of curving setæ of moderate length, longer on the posterior part of the abdomen. Ano-genital segment with two slender simple sensory setæ on each side. Integument tuberculate. Length: female, 1 mm.; male, 0·5 mm.

In small specimens the antennæ are shorter than the head. The number of teeth of the inner dorsal lamella increases with age. Thus a female specimen 1 mm. in length had seven teeth, and one 0·9 mm. had seventeen.

The many specimens that I have seen from the United States and Canada agree with the examples that I have received from Europe.

Sminthurides aquaticus var. **levanderi** Reuter

Sminthurus apicalis var. *Levanderi* Reuter, 1891.
Sminthurus aquaticus var. *levanderi* Schott 1894. Krausbauer, 1902.
Sminthurides aquaticus var. *levanderi* Borner, 1901a. Axelson, 1904, 1905a. Wahlgren, 1906a, 1906b. Axelson Immanuema, 1907, 1909, 1911, 1912.

Light or dark violet in colour; in other respects like the typical form.

The specimens collected by the Expedition belong to this variety, *levanderi*, and were all females, about half-grown.

The genus *Sminthurides* comprises a few species, that are of special interest in several ways. In this genus, as illustrated by *S. aquaticus*, the persistence of traces of segmentation in the abdomen, an archaic character (Willem, '00), helps us to understand the morphology of the trunk in the more specialized sminthurids. The antennæ of the male, with their peculiar hooks and tubercles, are modified to encircle and to hold those of the female at copulation, as described by Reuter ('80) and Levander ('94).

S. aquaticus, like the other species of its genus, lives on the surface of the water of ponds and streams, where it skips about in a lively manner, owing to structural adaptations of the furcula, particularly the large paddle-like mucrones. The species frequents the leaves of various aquatic plants, but occurs sometimes on pools where there is no visible vegetation. A few specimens that I examined at one time had desmids in the alimentary tract. This species is not limited to fresh water, but has been taken on pools of salt water also.

S. aquaticus is a common species in most parts of Europe, and is common also in many parts of the United States.

Fourteen specimens from the surface of ponds, Bernard harbour, Northwest Territories, May 25, 1916, July 9, 1915. F. Johansen.

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EXPLANATION OF PLATES.

All the figures except Nos. 19, 20, 67, 70 and 71 are from specimens collected by the Expedition.

PLATE 1.

Fig. 1. *Podura aquatica*, right hand foot, X 337.
2. *Podura aquatica*, dorsal aspect of left mucro, X 577
3. *Podura aquatica*, left mucro, X 577.
4. *Achorutes tullbergi*, eyes of left side, X 577.
5. *Achorutes tullbergi*, sense organ of third antennal segment of right side, X 908.
6. *Achorutes tullbergi*, right mid foot, X 577.
7. *Achorutes tullbergi*, left mucro, X 577.
8. *Achorutes tullbergi*, right mucro, X 577.
9. *Achorutes tullbergi*, left mucro, X 577.
10. *Achorutes tullbergi*, anal spines, X 908.

PLATE 2.

Fig. 11. *Achorutes tullbergi*, right anal spine, X 577.
12. *Achorutes sensilis*, postantennal organ and two eyes of left side, X 577.
13. *Achorutes sensilis*, sense organs of third antennal segment of left side, X 577.
14. *Achorutes sensilis*, left hind foot, X 341.
15. *Achorutes sensilis*, right mucro, X 577.
16. *Achorutes sensilis*, left mucro, X 577.
17. *Achorutes sensilis*, left anal spine, X 560.
18. *Achorutes sensilis*, dorsal setæ of second abdominal segment, X 297.
19. *Achorutes viaticus*, sense organ of third antennal segment of right side, from a European specimen, X 908.
20. *Achorutes viaticus*, dorsal setæ of second abdominal segment, from a European specimen, X 337.

PLATE 3.

Fig. 21. *Achorutes armatus*, left postantennal organ, X 505.
22. *Achorutes armatus*, right fore foot, X 300.
23. *Achorutes armatus*, left mucro, X 505.
24. *Achorutes armatus*, left anal spine, X 505.
25. *Achorutes armatus*, dorsal setæ of first abdominal segment, X 295.
26. *Onychiurus duodecimpunctatus*, right postantennal organ, X 505.
27. *Onychiurus duodecimpunctatus*, pseudocelli of right antennal base, X 295.
28. *Onychiurus duodecimpunctatus*, sense organ of third antennal segment of left side, X 800.
29. *Onychiurus duodecimpunctatus*, dorso-lateral aspect, to show pseudocelli, X 35.
30. *Onychiurus duodecimpunctatus*, left hind foot, X 505.

PLATE 4.

Fig. 31. *Onychiurus duodecimpunctatus*, right anal spine, X 635.
32. *Onychiurus duodecimpunctatus*, dorsal setæ of second abdominal segment, X 295.
33. *Tetracanthella wahlgreni*, X 42.
34. *Tetracanthella wahlgreni*, eyes and postantennal organ of right side, X 252.
35. *Tetracanthella wahlgreni*, sense organ of third antennal segment of left side, X 825.
36. *Tetracanthella wahlgreni*, extremity of abdomen, X 185.
37. *Tetracanthella wahlgreni*, dorsal aspect of anal spines, X 250.

PLATE 5

Fig. 38. *Tetracanthella wahlgreni*, left hind foot, X 505.
39. *Tetracanthella wahlgreni*, furcula and tenaculum, X 505.
40. *Tetracanthella wahlgreni*, dorsal aspect of mucrodentes, X 505.
41. *Tetracanthella wahlgreni*, dorsal setæ of first abdominal segment, X 295
42. *Folsomia quadrioculata*, eyes and postantennal organ of left side, X 505.
43. *Folsomia quadrioculata*, sense organ of third antennal segment of right side, X 825
44. *Folsomia quadrioculata*, right hind foot, X 505.
45. *Folsomia quadrioculata*, portion of furcula, X 505.
46. *Folsomia quadrioculata*, left aspect of furcula, X 295.
47. *Folsomia quadrioculata*, dorsal setæ of second abdominal segment, X 295.

PLATE 6.

Fig. 48. *Isotoma viridis*, eyes and postantennal organ of left side, X 185.
49. *Isotoma viridis*, left hind foot, X 295.
50. *Isotoma viridis*, left mucro, X 635.
51. *Isotoma viridis*, left aspect of tenaculum, X 185.
52. *Isotoma viridis*, dorsal setæ of third abdominal segment, X 145.
53. *Isotoma palustris*, eyes and postantennal organ of left side, X 166.
54. *Isotoma palustris*, left hind foot, X 495.
55. *Isotoma palustris*, left mucro, X 505.
56. *Isotoma palustris*, left aspect of tenaculum, X 250.
57. *Isotoma palustris*, dorsal setæ of second abdominal segment, X 250.

PLATE 7.

Fig. 58. *Entomobrya comparata*, dorsal pattern of head, X 77.
59. *Entomobrya comparata*, to show pigmentation, X 34.
60. *Entomobrya comparata*, eyes of right side, X 278.
61. *Entomobrya comparata*, left hind foot, X 475.
62. *Entomobrya comparata*, left mucro and end of dens, X 748.
63. *Entomobrya comparata*, left aspect of tenaculum, X 237.
64. *Lepidocyrtus cyaneus*, eyes of left side, X 282.
65. *Lepidocyrtus cyaneus*, left hind foot, X 748.
66. *Lepidocyrtus cyaneus*, left aspect of left mucro and end of dens, X 748.

PLATE 8.

Fig. 67. *Sminthurides aquaticus*, eyes of left side, X 400.
68. *Sminthurides aquaticus*, right mid foot, X 1010.
69. *Sminthurides aquaticus*, left hind foot, X 1010.
70. *Sminthurides aquaticus*, dorsal aspect of right mucro, X 513.
71. *Sminthurides aquaticus*, left mucro, X 513.
72. *Sminthurides aquaticus*, right aspect of tenaculum, X 673.
Figures 67, 70 and 71 are from Massachusetts specimens.

PLATE 1

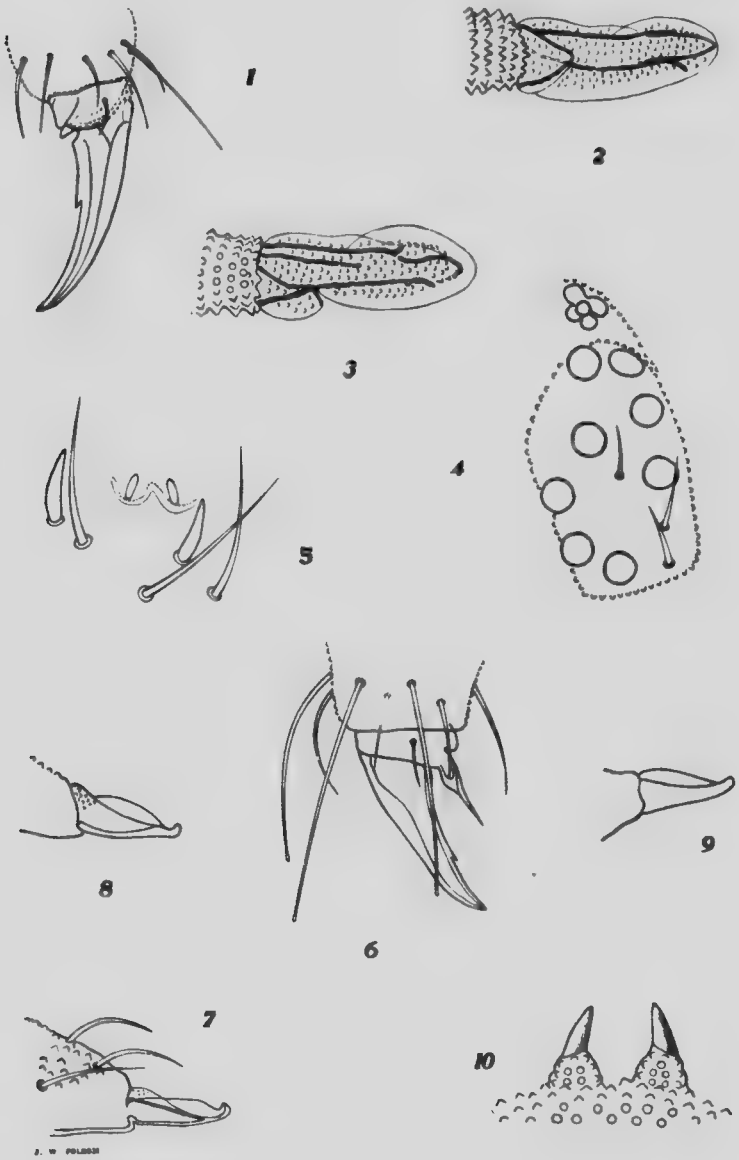
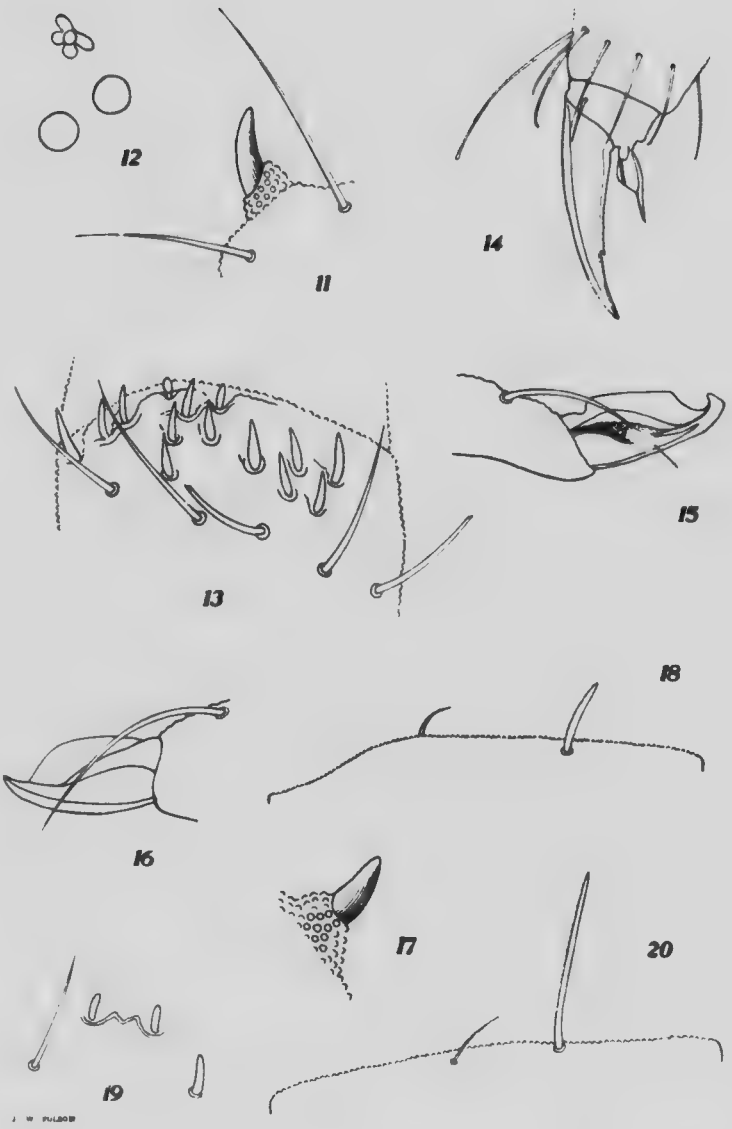


PLATE 2



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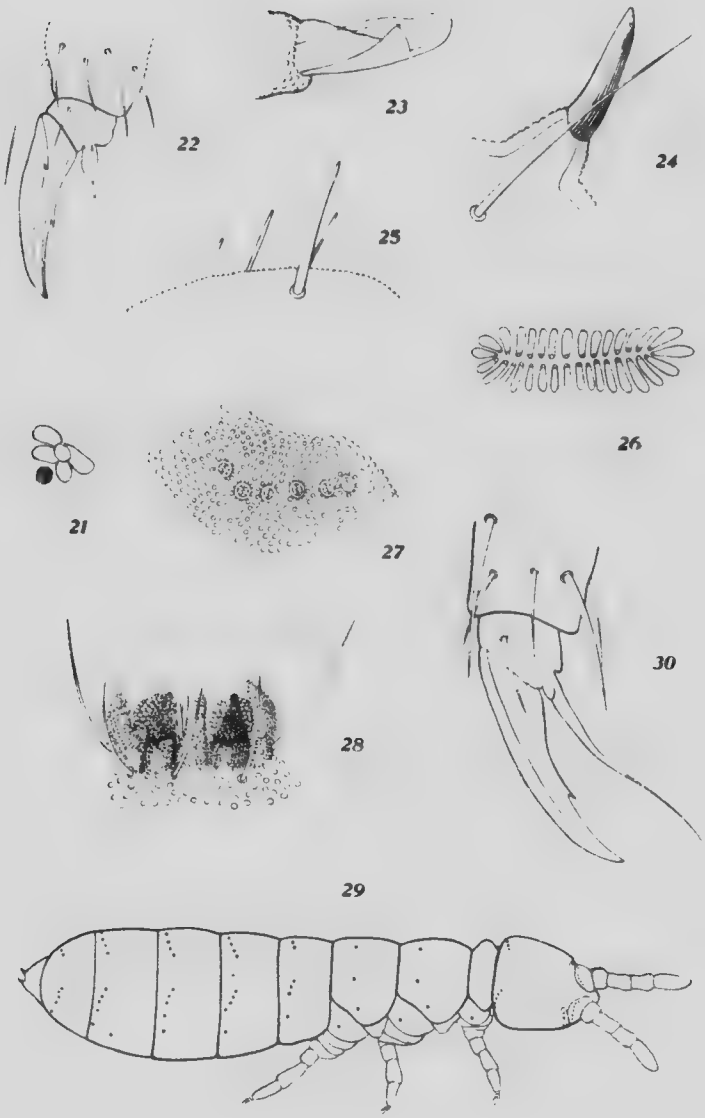

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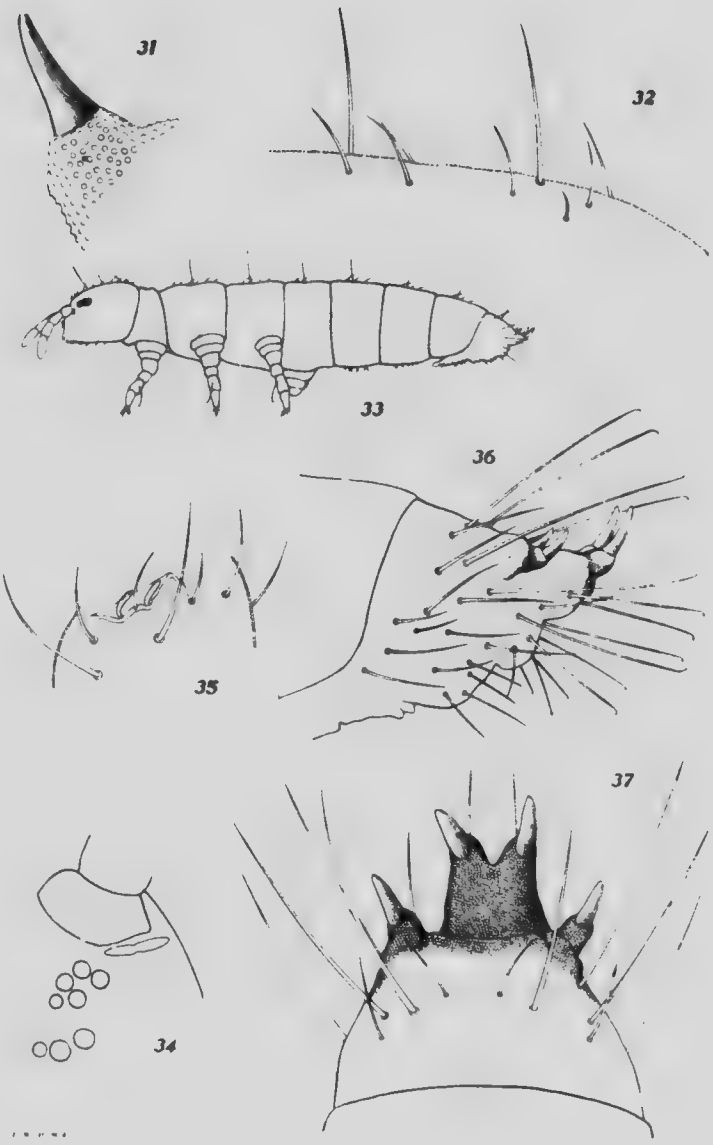

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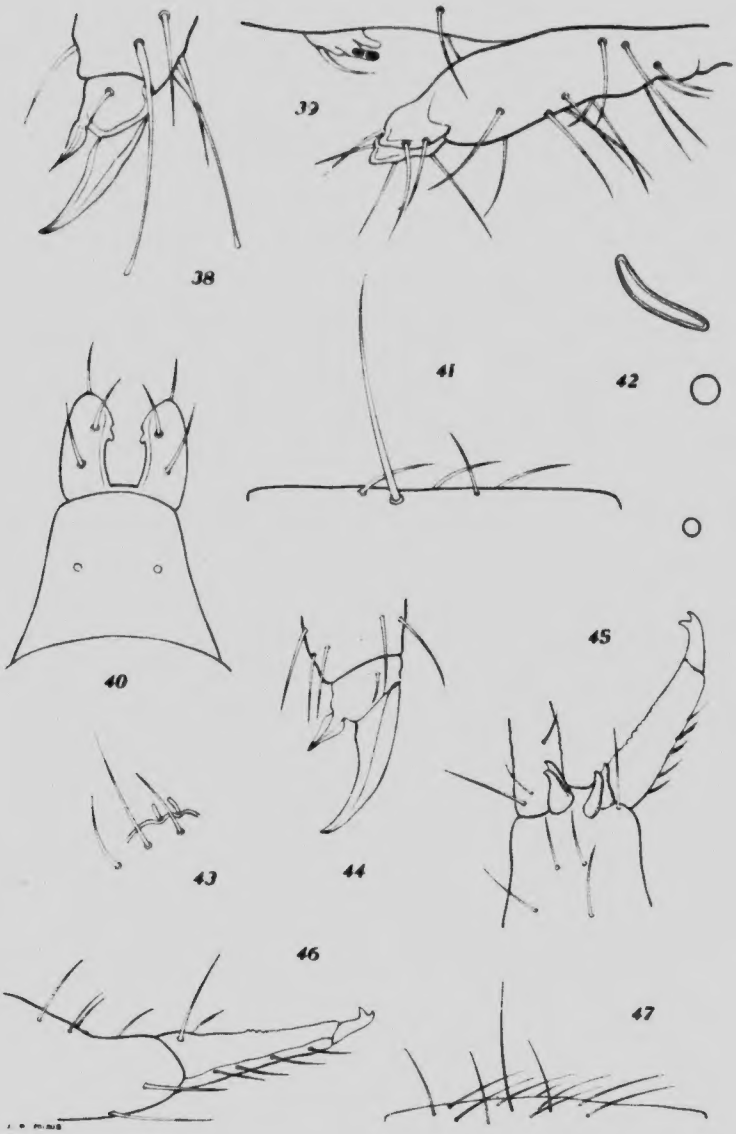

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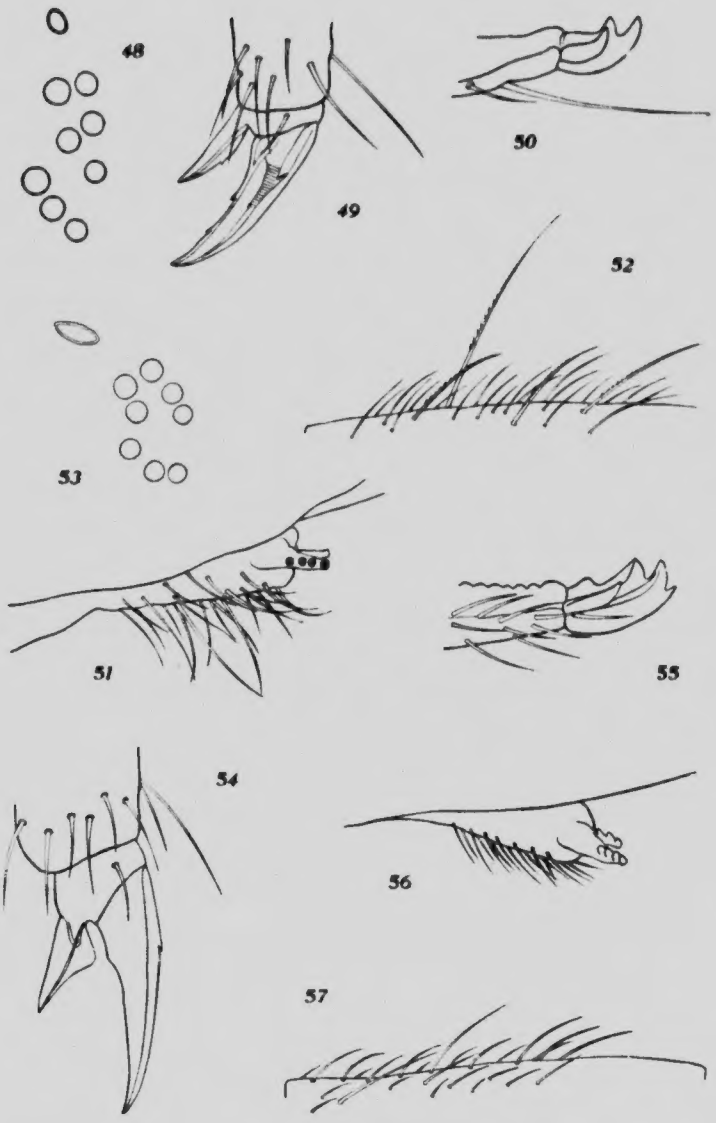

PLATE 7

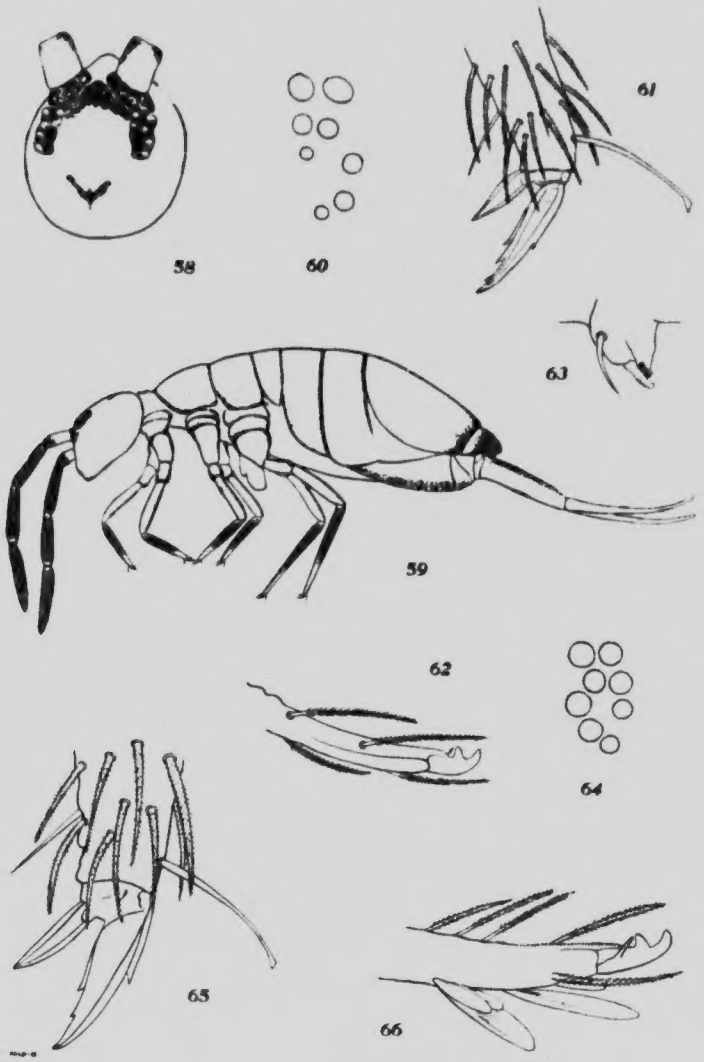

PLATE 8

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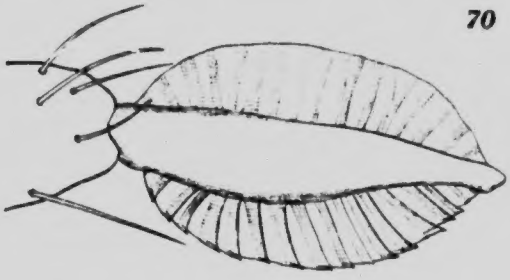

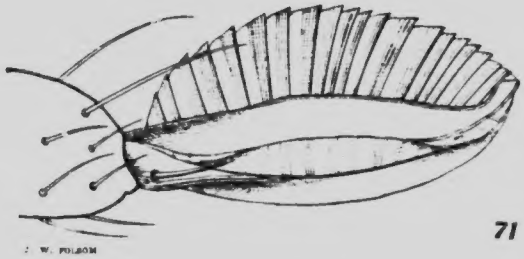

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J. W. FOLSOM